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What Are the Differences in the Area of Profitability and Efficiency When Early and Late Adopters Are Analyzed Regarding the Basel III Leverage Ratio?

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Abstract: This research investigates whether banks that adopted new regulatory requirements earlier, such as Basel III, are more profitable, as well as more efficient, than banks that adopted these requirements later. In addition, all 138 banks are based in the G7 member countries, which are the most developed countries in the world. Also, banks are categorized into early and late adopters based on Basel III Leverage Ratio performance by using Fitch Connect. Moreover, profitability ratios, such as the Return on Equity, Return on Assets and efficiency ratio Operating Efficiency, were collected from Fitch Connect to analyze if early adopters were more profitable and efficient than the late adopters. Also, STATA is used to analyze descriptive statistics and a univariate analysis of both groups. Furthermore, the finding is that early adopters of the Basel III Leverage Ratio are not the more profitable or efficient firms compared to late adopters as anticipated. In addition, the results of early and late adopters do not differ that much in the analysis regarding profitability and efficiency ratios. This implies that it is not necessarily correct to assume that stricter regulation, such as Basel III, will negatively affect the profitability or efficiency of banks. In addition, these results are useful to regulators and policymakers of the G7 member countries for two reasons. Also, regulators can clearly see how banks are adopting new stricter regulation.

Keywords: Return on Equity; Return on Asset; Basel III Leverage Ratio

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1. Introduction

Banks take a depositor's money and with that money, banks provide loans to consumers and businesses, which encourages economic growth (CFI 2023a). In addition, banks invest money in various assets. For example, banks can invest money in government securities, which usually positively affects economic growth (CFI 2023a). Therefore, the banking sector is known as the primary supplier of credit, which provides money for people to buy homes, as well as for businesses to buy equipment or expand their operations. Furthermore, for most people, banks are very safe places to keep their money because in most countries, deposits in banks are insured up to a certain amount if a bank goes bankrupt. Also, when people put money in a bank, they can receive good interest rates, attracting even more people, which positively affects banks.

A crucial aspect of banking is regulation and the evolution of regulation throughout years to ensure stable banking. Basel I only considered credit risk and capital (BIS 2023). However, Basel II added market risk and operational risk, as well as three supervisory pillars (BIS 2023). Furthermore, after the 2008 financial crisis, Basel III was introduced and because of Basel III introduction, bank regulation evolved even further. Specifically, Basel III introduced a few new things, such as the Counter Cyclical Capital Buffer and two

liquidity ratios, the Liquidity Coverage Ratio and Net Stable Funding Ratio (BIS 2023), in addition to the Basel III Leverage Ratio. Therefore, the goal of Basel III is to safeguard banks from taking too much risk.

Furthermore, despite improvements and the evolution of regulation, bank failure is still possible today. For example, three banks in the first half of 2023 failed in the US including Silicon Valley Bank, Signature Bank, and First Republic (Hooker 2023). In addition, in Europe, Credit Suisse was acquired by UBS. Moreover, the banking failure is important to investigate because it gives opportunities for regulators to identify issues that may not have been visible before. Also, from banking failure, regulators can learn how to protect the economy in a better way and prevent the same situation from happening again.

The aim of this study is to investigate whether early adopters of Basel III are more profitable and efficient than the late adopters of Basel III. Furthermore, this is performed by categorizing banks into early and late adopters based on the Basel III Leverage Ratio performance. Also, data for the leverage ratio, profitability, and efficiency were collected from Fitch Connect to conduct an analysis via STATA software (Version 18).

The key thing is that all banks need to implement Basel III regulations regardless of their situation or specific conditions. However, not all banks are in the same situation when Basel III implementation is analyzed. Specifically, large banks have a lot more resources, as well as experienced staff that know how to deal with regulation efficiently. In addition, as is evident from the 2008 global financial crisis, if large banks fail, the economy can experience enormous consequences. Therefore, the priority of regulators is to prevent this case by limiting the probability of bank failure to the lowest possible level. This is especially the case for large banking institutions. Another key thing to mention is that after the 2008 financial crisis, changes to the financial system were anticipated; because of this, some banks decided to implement regulation earlier rather than later. Furthermore, there is the possibility that due to earlier implementation, banks will not have problems regarding profitability as well as efficiency that were discussed above compared to banks that decided to implement regulation later. Therefore, if banks operate perfectly fine but the country is having issues with inflation and unemployment at the time of implementation, this can damage or hurt bank operations, and may postpone implementation of regulatory requirements.

Moreover, the following research is conducted regarding the impact of Basel III on banks. For example, Golubeva et al. (2019) only researched 45 European banks while research by Gržeta et al. (2023) analyzed more banks in Europe regarding Basel III regulation. Also, another study by Ali and Bansal (2019) examined the impact of Basel III on bank profitability only in Bahrain. Therefore, Rajput and Sankaran (2019) examined Indian public sector banks with a focus on profitability and not comparing them with private sector banks in India is a limitation of their study when Basel III impact on the Indian banking sector is analyzed. On the other hand, Haj Khlifa and Zaki (2021) had a sample of only six banks. Furthermore, this study addresses the weakness of previous research by analyzing banks around the world. Also, this research analyses the impact of Basel III on both bank profitability and bank efficiency whereas other studies focused only on one area. We are distinguished from previous research by having a larger number of banks in our sample. In addition, the contribution of this study is a unique classification where it classifies banks into earlier adopters and later adopters whereas other studies did not classify banks in that order.

The remainder of this paper is constructed as follows: Section 2 covers the literature review. Section 3 describes the methodology, sample selection, variable selection, categorization criteria, and univariate analysis. Section 4 discusses the results. Section 5 provides the discussion and conclusion.

2. Literature Review

2.1. Introduction

The purpose of this section is to review the literature on Basel regulation. In order to achieve this objective, for the rest of the literature review we will discuss Basel evolution, specifically, how Basel evolved from Basel I to Basel III. Also, the section will mention key years regarding Basel I, Basel II, and Basel III implementation. Moreover, there will be a discussion of how Basel III affects banking operations regarding leverage, profitability, and efficiency.

Therefore, previous research from Acosta-Smith et al. (2020) examined bank risk-taking activities that are increasing because of the leverage ratio and found that the introduction of leverage into Basel III leads to more stable banks, which is very positive for the banking industry. Meanwhile, Allahrakha et al. (2018) researched how the leverage ratio encourages bank risk-taking, and concluded that banks can favor higher and riskier returns that lead to a potential downside of the leverage ratio requirement. However, no studies have looked at early adopters of the Basel III accord before it became mandatory for banks. Moreover, looking at early versus late adopters is interesting to investigate because it can give a picture of how banks are coping with new challenges that can affect their business.

2.2. Evolution of Basel Accord

Bank of International Settlements known as BIS introduced Basel I in 1988 to reduce systemic risk in banking. Also, according to Dogra and Kaur (2020), Basel I imposed minimum capital requirements against risk. In addition, Basel I focused on capital plus credit risk. While there were modifications regarding Basel I, most importantly, BIS added market risk in 1997 (BIS 2023). To mention more, market risk includes interest rate risk, currency risk, equity risk, and commodity risk. Furthermore, Tier one capital and Tier two capital were required by Basel I, and banks need to hold 8% of capital for risk-taking activities (BIS 2023). Therefore, Tier one capital includes retained earnings, preferred stock, and common stock (BIS 2023). However, Tier two capital includes subordinated debt, revaluation reserves, general loan loss reserves, hybrid (debt and equity) capital instruments, and undisclosed reserves (BIS 2023). One of the key parts of Basel I is credit risk weights, as well. Specifically, 100% is for consumer and commercial loans and 50% is for residential mortgages. Also, the OECD interbank claim is 20% but emerging country government bonds are 20%. Meanwhile, 0% is for cash, as well as for OECD government bonds (BIS 2023).

Moreover, BIS introduced in 1999 Basel II while Basel II implementation finished in 2006 (BIS 2023). In addition, an 8% minimum capital requirement as well as Tier one and Tier two capital are carried from Basel I to Basel II. Also, one of the changes that happened in Basel II is a change in risk weights, such as 150% for consumer loans and 35% for mortgages. Meanwhile, risk weights regarding government bonds of emerging countries are 0% under Basel II. Additionally, Basel II includes operational risk, as well. To mention more, three pillars were introduced by Basel II, as well. The first pillar is minimum capital requirements, which focus on risk calculations regarding credit risk, market risk, and operational risk. Risks, such as operational risk and credit risk, can be calculated by using the Advanced Level Approach, Standardized Approach, and Basic Indicator Approach. Meanwhile, Value at Risk is the recommended method to estimate market risk. In addition, pillar one deals with the maintenance of regulatory capital. Also, Basel II pillar two is the supervisory review process and the goal of this pillar is to help regulators examine whether a bank can meet requirements, as well as examine bank capital adequacy. To mention more, there is a framework for risk dealing in the area of liquidity, pensions, reputation, strategy, as well as systemic risk and legal risks. Therefore, Basel II pillar three is a market discipline that focuses on how banks disclose their requirements regarding risk and capital (BIS 2023).

Therefore, after the 2008 crisis, there was a new Basel standard called Basel III. Also, Basel III strengthened requirements regarding capital because of the 2008 financial crisis. Specifically, Basel III was implemented in steps from 2013 to 2019 but it was proposed in

2010. Moreover, Basel III introduced a Capital Conservation Buffer that requires banks to hold 2.5% of risk-weighted assets and CCB is an additional layer of common equity, and a Counter-Cyclical Capital Buffer is also introduced. Also, according to Basel III, the Counter-Cyclical Capital Buffer is built when there is strong economic growth to prevent pressure on capital during stress periods in a financial crisis (BIS 2023). Therefore, banks will be able to use capital reserve accumulated during the economic boom in the period of financial stress and use it to maintain smooth credit activity (Pfeifer and Pikhart 2019). Additionally, Liu and Molise (2019) concluded that the Basel III Counter-Cyclical Capital Buffer (CCB) effectively prevents fluctuations in housing and credit markets, and prevents bubbles. In addition, it reduces financial shocks and economic downturns, as well as preventing systemic risk. However, extra capital can reduce or negatively affect bank lending (Naceur et al. 2018). Also, Basel III tightens capital adequacy requirements for banks by increasing the minimum Tier 1 regulatory capital from four to six percent because the mission of Basel III is to reduce risk-taking activities via better capital management (Jutasompakorn et al. 2021).

Furthermore, Basel III introduced liquidity ratios, such as the Liquidity Coverage Ratio (LCR), as well as the Net Stable Funding Ratio (NSFR). Therefore, Veeramoothoo and Hammoudeh (2022) found that Basel III liquidity requirements will have a significant impact on banks with low profitability compared to banks with high profitability. In addition, small banks are more vulnerable to short-term liquidity risks while big banks are more affected by long-term liquidity risks (Veeramoothoo and Hammoudeh 2022). Usually, holding more liquid assets is generally desirable industry-wide because it lowers the risk of individual banks going bankrupt during a liquidity stress period. However, liquid assets are not attractive to banks because they tend to yield lower returns than illiquid assets during normal times, which poses a new challenge for banks. Also, when banks are choosing how much liquid assets to keep above the required levels prescribed by Basel III, banks need to consider profit goals against their risk of bankruptcy. Additionally, Roulet (2018) concluded that large international banks will more easily implement the Basel III liquidity framework because of extra resources. However, smaller banks need to follow the same Basel III standards, as well. Also, Basel III proposed extra loss absorbency and more capital for global systematically important banks (BIS 2023).

2.3. Basel III Leverage Ratio

Therefore, Li (2020) and Allahrakha et al. (2018) describe how the leverage ratio proposed by Basel III affects banks, as well as what positive and negative impact the Basel III Leverage Ratio has on the banks. Furthermore, the leverage ratio increased the quality and quantity of regulatory capital for banks that need to be held for different activities.

Moreover, Barth and Seckinger (2018) found that banks differ in monitoring skills and in their ability to complete risky investment projects. Also, a tighter leverage ratio helps to mitigate moral hazard (Barth and Seckinger 2018) but there are consequences for big banks that are not able to absorb the entire supply of debt when it is too costly to issue new equity. On the other hand, Allahrakha et al. (2018) concluded that the leverage ratio encourages bank risk-taking and because of this, banks tend to move away from low-return and low-risk assets in favor of high-return and high-risk assets.

Also, Barth and Miller (2018) investigated costs as well as the benefits of the leverage ratio and the authors found that the benefit of the leverage ratio proposed by Basel III is a reduced probability of a banking crisis while costs regarding the leverage ratio arise from reduced lending that can be passed onto borrowers via higher interest rates on loans and mortgages, as well as other financial products. Also, Barth and Miller's (2018) research is similar to Acosta-Smith et al.'s (2020) research that analyzed European banks to see how additional loss-absorbing capacity affects banks and whether there is an increase in risk-taking activities because of the leverage ratio. Moreover, Acosta-Smith et al. (2020) found that a leverage ratio can incentivize banks to increase their risk-taking, which is the downside of a leverage ratio, and this is confirmed by Allahrakha et al. (2018). However,

increased risk-taking should be outweighed by the benefits of higher capital that limits bank risk-taking, thereby leading to more stable banks (Acosta-Smith et al. 2020). While the benefit of increased loss-absorbing capacity via the leverage ratio outweighs the negative impact of risk-taking, there is a limit to how much additional risk a bank can take. Banks that take high risks need to hold greater capital to survive shocks, as well.

Research performed by Kocsis and Seregdi (2021) revealed that the business model of banks can be impacted by the introduction of new regulatory requirements, such as the leverage ratio that is proposed by Basel III. Banks that are struggling with meeting the leverage ratio requirement have low average risk weight and a significant proportion of Tier 2 capital (Kocsis and Seregdi 2021). They can achieve compliance with new requirements by raising Tier 1 capital or by changing the business model (Kocsis and Seregdi 2021). Additionally, the leverage ratio will not increase the bank's funds and there is a risk that low-risk items, such as retail mortgages, will become more expensive, or there is the possibility of financing these items via securitization. Therefore, this will result in higher risk exposure, which will weaken the financial stability of banks. Also, Kocsis and Seregdi (2021) concluded that the introduction of a leverage ratio encourages banks to take higher risks in the EU but increased capital available from the leverage ratio can outweigh the negative effect and this is confirmed in the previous paragraph, as well. Moreover, raising new capital involves costs for banks and it is logical for banks themselves to invest in higher yielding but riskier assets (Kocsis and Seregdi 2021). This cannot be carried out easily as risk-weighted capital adequacy requirements will prevent risk-taking. In addition, Kocsis and Seregdi's (2021) findings are similar to those of Acosta-Smith et al. (2020) because these authors researched and focused on European banks.

In addition, further research on the leverage ratio is performed by authors such as Li (2020). Furthermore, Li (2020) concluded that the leverage ratio has more impact on smaller commercial banks. In addition, the leverage ratio limits the credit expansion of commercial banks, and it improves bank stability (Li 2020), which is confirmed in the previous paragraph.

2.4. Basel III: Impact on Bank Profitability and Efficiency

Moreover, Le et al. (2020) examined how stricter requirements under Basel III are impacting the profitability and efficiency of the banking sector. Also, Le et al. (2020) used a sample of the largest commercial banks from the UK, as well as Australia, over the period from 2000 to 2019. Additionally, regarding methodology, Le et al. (2020) used Fully Modified OLS and Dynamic OLS estimation approaches. Moreover, efficiency is measured by earnings before income and tax (EBIT); other measures used in the research were Return on Assets (ROA), Return on Equity (ROE), and Net Income. In addition, the effect of bank size, inflation, real interest rates, unemployment, and GDP was involved. Also, there is a negative correlation between bank efficiency as a measure of ROE and ROA, which are measures of bank profitability (Le et al. 2020). A further crucial discovery made by Le et al. (2020) found that economic factors have different effects on the bank efficiency and profitability in the UK and Australia. However, a higher inflation rate and real interest rates in the UK boost bank profitability and efficiency. On the other hand, in Australia, lower inflation and lower interest rates enhance bank profitability and efficiency. For both countries, the banking sector benefits from country growth, higher GDP, as well as lower levels of unemployment (Le et al. 2020). Furthermore, the restricted capital required by Basel III improves operating performance, but it devalues bank profitability and bank efficiency (Le et al. 2020). However, the capital provides the ability to absorb losses and plays a core part in resilience against adverse shocks and it is more expensive than other sources of funding since investors expect higher compensation for the risk they bear. The positive thing about Le et al.'s (2020) research is that the authors stated how banks can meet the higher capital requirement but still have profitable and efficient operations. Also, banks are encouraged to diversify lending activities, such as housing lending, capital-intensive and lower-return lending, the repricing of loans, repricing of deposit liabilities, lengthening of the maturity

of liabilities, and a continued shift toward more stable sources of funding (Le et al. 2020). As a result, all modified lending activities are likely to increase capital and have a direct effect on bank profitability. Moreover, low profitability can prevent bank expansion and extension of additional credit to the real economy (Le et al. 2020). Also, policymakers should not only monitor the implementation of the post-crisis Basel III requirements, but they should keep attention on unexpected events (Le et al. 2020). Furthermore, the drawback of Le et al.'s (2020) study is the limited focus only on UK and Australia because other countries can be exposed to the same problems, as well. Additionally, there are differences between developed and developing countries when banking systems are analyzed. The positive thing is that authors Lileikienė et al. (2021) analyzed banks on both continents, such as USA and Europe, regarding efficiency impact on profitability. Also, banks that struggled with profitability before Basel III are expected to struggle even more because the balance sheet needs to be reduced to meet stricter capital requirements (Andrle et al. 2019). Meanwhile, bank efficiency benefits from increasing GDP results (Kondova and Bandyopadhyay 2019).

On the other hand, Obadire et al. (2022) concluded that the core function of a commercial bank is the provision of credit facilities to its customers and to keep the flow and cycle of economic and financial resources balanced, as well. Also, banks can perform these functions only if they are well regulated and efficient (Obadire et al. 2022). The goal of Obadire et al.'s (2022) research was to analyze the efficiency of African banks to see how Basel III affects them. Additionally, 45 listed banks from six African countries, such as South Africa, Nigeria, Kenya, Tanzania, Uganda, and Malawi, were analyzed from 2010 to 2019 (Obadire et al. 2022), which is very good compared to Duho et al. (2020) who only analyzed banks that are based in Ghana. Specifically, Obadire et al. (2022) investigated how Basel III affects the operational and investment efficiency of African banks by using Random Effects and Pooled Ordinary Least Square regression models. Specifically an input-oriented DEA approach was used to see the efficiency level of the African banks (Obadire et al. 2022). Additionally, capital buffer premiums significantly affect operating and investment efficiency in a positive way (Obadire et al. 2022). Furthermore, a capital buffer premium not only serves as a cushion of capital against financial, market, and economic shocks but also improves bank efficiency by influencing banks' decisions and perspectives on cost containment strategies (Obadire et al. 2022). Another positive finding by Obadire et al. (2022) is that banks who successfully meet LCR are efficient in operations with the ability to successfully meet short-term obligations, such as meeting customer credit needs, unannounced depositors' withdrawals, as well as creditor repayments. Therefore, adopting stricter liquidity requirements creates a liquidity buffer for African banks, which gives them confidence to pursue profitable and high-yielding projects, which leads to increased profitability, as well as operational efficiency (Obadire et al. 2022). Therefore, banks should aim to operate at lower costs while maximizing returns (Obadire et al. 2022). One positive thing to mention regarding bank efficiency is that banks can be more efficient by merging branches, reducing the number of physical offices, and strengthening corporate governance to enhance financial stability (Obadire et al. 2022). In addition, the investment and operational efficiency of banks can be good if they can successfully identify and issue credit and loans to highly credit-worthy customers via proper monitoring of borrowers, which reduces default probability (Obadire et al. 2022). Furthermore, bank efficiency is under attention these days because of the 2008 crisis when the economy lost most of its GDP as the inflation, interest rate, and unemployment were on the rise (Obadire et al. 2022). However, the benefit of a well-regulated banking system is strong economic development as confirmed by Le et al. (2020). Moreover, commercial banks with stricter capital regulations are more operationally efficient because new capital adequacy requirements enhance operational efficiency and profitability (Obadire et al. 2022). Usually, the view is that higher capital requirements reduce the availability of funds for investment and operational lending activities, which affects bank efficiency. Moreover, inefficient banks held more capital with a lower-risk appetite while efficient banks held less capital with higher responsiveness in their risk behaviors, resulting in better financial performance (Obadire et al. 2022). How-

ever, this is the case for developed countries (Obadire et al. 2022). To mention more, the limitation of Obadire et al.'s (2022) research is that only banks from African countries are analyzed, as well.

One more interesting study was carried out by Adelopo et al. (2022), which examined banks in the European Union from 28 countries. Also, for the period 2010 to 2018, Adelopo et al. (2022) found that the EU banking industry should strengthen bank capital and asset quality to ensure sustainable profitability in the long term. Furthermore, Adelopo et al. (2022) concluded that there is limited influence of Basel III on bank profitability in the EU countries. Meanwhile, a positive thing about Adelopo et al.'s (2022) research is the consideration of profitability measures, such as Return on Assets, Return on Equity, and Operating Profit to Risk-Weighted Assets. In addition, other important factors that Adelopo et al. (2022) analyzed during the research were capital, liquidity size, and asset quality regarding banks. Meanwhile, economic growth and inflation are also considered.

Moreover, Swamy (2018) analyzed how the Basel III framework can affect bank profitability in India. Also, an interesting finding by Swamy (2018) is that an increase in capital ratios raises interest income for banks. Additionally, there are significant macroeconomic benefits of raising bank equity but Swamy (2018) did not go into specifics regarding this. Therefore, Basel III has a significant impact on the Indian financial sector (Swamy 2018). Furthermore, assessing profitability is important because it has an impact on the lending efficiency of the banking system and this is confirmed by Obadire et al. (2022). Also, bank profitability affects capital generation capacity, as well. Another important point is that an increase in equity capital increases the weighted average cost of capital and banks can pass this on to borrowers to improve profitability via higher lending rates (Swamy 2018). In addition, because of this, there is a possibility of increased bank efficiency, as well. However, the positive thing of work by Thomas et al. (2023) is that the authors compared Indian banks to UAE banks and they focused on how economic factors are affecting Basel III implementation.

3. Methodology

Methodologies, such as a univariate analysis, which includes the Parametric Mean Comparison *t*-test and Nonparametric Wilcoxon Sign Rank test known as the median test, via STATA are used to conduct an analysis. In addition, STATA is used for descriptive statistics to analyze the performance of early and late adopters. Also, these mentioned methodologies help us address the aim to see which group of adopters is more profitable and efficient.

Profitability and efficiency are expected to decrease in some way but numbers for banks will be different and there is the possibility of larger gaps between some banks. Al-so, a bank can take certain measures to increase profitability and efficiency such as reducing the workforce, increasing prices of financial products, as well as withdrawing from certain markets or businesses. Based on the discussion above, the following two hypotheses were developed:

H1. *Early adopters of the Basel III leverage requirement will be more profitable than late adopters.*

H2. *Early adopters of the Basel III leverage requirement will be more efficient than the late adopters.*

3.1. Sample Selection

The sample in this study consists of 138 banks that provide various banking services (Table 1). Also, the 138 banks belong to seven G7 countries, namely Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States of America (International Institute for Sustainable Development 2021). The main reason for this selection is because of good data availability. Moreover, banks that only have headquarters in the analyzed countries are included in the analysis.

Table 1. The composition of the examined sample of banks by country of headquarters.

No.	G7 Country	Banks in the Sample
1.	Canada	12
2.	France	15
3.	Germany	8
4.	Italy	20
5.	Japan	20
6.	United Kingdom	13
7.	United States of America	50
	Total:	**138**

Source: Created by the authors according to data from Eikon (London Stock Exchange Group, London, UK).

In addition, banks are selected based on market capitalization using the Eikon database. While the Eikon database provides a longer list of banks based on market capitalization for some countries such as Italy, Japan, and the United States of America, this is not the case with other countries. Moreover, this is the reason why some countries have more banks included in the sample. Specifically, when Eikon provides a list of banks based on market capitalization, if those banks lack data on the Fitch Connect database, such as the Basel III Leverage Ratio, then these banks are not analyzed because they cannot be classified into early or late adopters of the Basel III Leverage Ratio. Additionally, data frequency is on an annual basis specifically accounting for data.

3.2. Variable Selection

This part will discuss variables, such as the Return on Equity, Return on Assets, leverage ratio, and Operating Efficiency measure. Also, this research focuses on Almaqtari et al. (2019) who analyzed bank efficiency and profitability. Moreover, this research wants to investigate how profitability and efficiency variables are impacted by the Basel III leverage implementation.

Return on Equity (ROE): ROE measures the company's net profit divided by the total equity (CFI 2023c). Moreover, net profit is compared to total equity, which represents the total Return on Equity and shows a firm ability to turn equity investments into profits (CFI 2023c). Furthermore, an increasing ROE over time means a company reinvests earnings wisely. Meanwhile, low ROE means the opposite (CFI 2023c). However, this is not always the case because company ROE can still increase even when all earnings are paid out in the forms of dividends and earnings are specifically not reinvested (Almaqtari et al. 2019).

$$Return\ on\ Equity = \frac{Net\ Profit}{Total\ Equity} \quad (1)$$

Operating Efficiency: Operating Efficiency measures how efficiently a bank is managing its costs (Taylor 2021). Also, banks are trying to keep this metric low (Taylor 2021). Moreover, operating expenses include salaries and office equipment. These costs are stable over time, but the bank's income is not (Taylor 2021). In addition, new regulations can cause extra costs for banks. This can make the metric volatile especially if banks' income drops from one year to the next (Taylor 2021; Almaqtari et al. 2019).

$$Operating\ Efficiency = \frac{Total\ Operating\ Expenses}{Net\ Interest\ Income} \quad (2)$$

Return on Assets (ROA): This ratio measures the profitability of a business regarding assets (CFI 2023b). ROA indicates how well a company is performing by comparing the net profit it is generating to the capital it invested in assets (CFI 2023b). Also, a higher ROA is

very positive because a company is using resources efficiently while a low ROA indicates the opposite (CFI 2023b; Almaqtari et al. 2019).

$$Return\ on\ Asset = \frac{Net\ Profit}{Average\ Total\ Asset} \tag{3}$$

Leverage Ratio: The leverage ratio introduced by Basel III should reduce periods of deleveraging in the future (BIS 2014). The main reason for this is that in the 2008 financial crisis, banks had excessive leverage and off-balance sheet leverage. However, banks maintained strong risk-based capital ratios. This created in the crisis a circle of losses and reduced the availability of credit in the real economy (BIS 2014).

$$Leverage\ Ratio = \frac{Capital\ measure}{Exposure} \tag{4}$$

The leverage ratio is expressed as a percentage while 3% is the minimum requirement (BIS 2014). Moreover, the leverage ratio capital measure is Tier one capital regarding risk-based capital for Basel III. However, there are also exposures, such as securities financing transaction exposures, derivative exposures, and off-balance sheet exposures, on on-balance sheet exposures (BIS 2014).

The data source for variables is Fitch Connect. Also, profitability and efficiency are investigated because they give a clear picture of how banks are performing.

3.3. Categorizing Early and Late Adopters of Basel III

Early and late adopters of Basel III (Table 2) are categorized by examining the Basel III Leverage Ratio on Fitch Connect from 2015 to 2022 and by investigating banks' financial reports. Moreover, banks are required to disclose the Basel III Leverage Ratio from 2015 and the leverage ratio should be higher than three percent (BIS 2014). Also, when the leverage ratio from 2015 is three percent or above, then banks are classified as early adopters. However, banks are classified as late adopters when the leverage ratio is below three percent. In addition, if there are fluctuations in the leverage ratio around three percent during the analyzed years but the average leverage ratio is less than three percent during the analysis, then the bank is classified as a late adopter. Also, banks are classified as late adopters when it was not possible to find data for the leverage ratio on Fitch Connect and in the financial reports because banks are required to disclose the ratio and that means banks are still dealing with the adoption of regulation. Moreover, the number of such cases in the examined sample is very small in each country and it does not affect overall results.

For example, in France, only the three biggest banks adopted the Basel III leverage regulation early in 2015. Furthermore, Japan is in a similar situation where only two banks adopted a leverage ratio early. However, some early adopters in France and Japan had weaker leverage ratio performance. Moreover, in Canada, six banks have a good leverage ratio throughout the whole analyzed period, but the other six banks are classified as late adopters. The reason for this classification is that two banks did not adopt leverage ratios while four other banks had very weak leverage ratio performance at the beginning of the analysis. Regarding Germany, three banks did adopt the leverage ratio early in 2015 but Aareal Bank, which is an early adopter, has missing values for 2021 and 2022 probably due to the COVID-19 crisis. Also, in the case of Germany, late adopters are three banks because they did not report the leverage ratio in 2015 and two of them have weak leverage ratio performance. Moreover, most UK banks are quite good at adopting the leverage ratio except for three banks, but one early adopter has a missing value in 2022. A similar situation is in the USA where out of 50 banks only 10 of them did not adopt the leverage ratio.

Table 2. Early and Late Adopters.

No.	G7 Country	Banks in the Sample	Early Adopters of Basel III Leverage	%	Late Adopters of Basel III Leverage	%
1.	Canada	12	6	50.00	6	50.00
2.	France	15	3	20.00	12	80.00
3.	Germany	8	3	37.50	5	62.50
4.	Italy	20	8	40.00	12	60.00
5.	Japan	20	2	10.00	18	90.00
6.	United Kingdom	13	10	76.92	3	23.08
7.	USA	50	40	80.00	10	20.00
	Total:	**138**	**72**	-	**66**	-

Source: Created by the authors according to data from Eikon.

3.4. Univariate Analysis

This section will discuss H1 and H2 hypotheses from the literature review. Also, two measures of the univariate analysis will be examined via STATA. One is the Mean Comparison *t*-test, which compares the mean of two groups. Also, group one is early adopters while group two is late adopters, and the goal is to test the two hypotheses to see whether Basel III leverage affects the profitability and efficiency of the banks. Specifically, the mean of a variable, such as Return on Assets, Return on Equity, and Operating Efficiency, regarding early adopters is compared to the mean variable of late adopters.

The second measure is the Nonparametric Test. The goal of this test is to analyze two related samples (early and late adopters of Basel III leverage) to identify whether there are any differences between groups regarding the median.

Also, the reason for using two tests is to examine the robustness check because the parametric test has certain assumptions that have to be met to be used. Specifically, there is a normality assumption that assumes data have a normal distribution or data need to be symmetric (Meek et al. 2007). Another assumption is variance homogeneity where data from multiple groups have the same variance. In addition, there is a linearity assumption, which assumes that data have a linear relationship. Moreover, data for each group should be randomly sampled from the population. On the other hand, the Nonparametric Wilcoxon Sign Rank test does not have normal distribution assumptions (Meek et al. 2007). Also, this analysis is not dependent on the nature of the normal distribution. Furthermore, the median test examines whether two or more samples from populations have the same median (Meek et al. 2007). Meanwhile, one sample is from a population with a different median according to the alternative hypothesis.

4. Results

This section aims to show the results of the methodology that is used, such as the Mean Comparison t-test with equal and unequal variances and the median test. Moreover, there are 138 banks in a sample from G7 member countries based on market capitalization. However, 66 banks are late adopters of the Basel III leverage requirement, and the remaining 72 banks are early adopters. Also, robustness checks are performed to examine the results. In addition, descriptive statistics are analyzed for banks in each country. There is an analysis of descriptive statistics for early and late adopters.

Also, when the mean ROE is analyzed, it is evident that the Canadian banks have the highest value of 13.498 (Table 3) while France and Germany have the lowest. Moreover, Japan's, Italy's, the UK's, and the US's mean ROE (Table 3) are in the middle among these countries. This means that Canadian banks have very good profitability despite stricter Basel III. Therefore, the situation is similar for mean ROA because Canadian banks have the highest mean ROA (2.083) (Table 3) but Italian and German banks have the lowest values, as

well as French banks (Table 3). However, Japanese banks are excellent performers regarding the mean ROA (Table 3). Also, the UK and USA have similar values for mean ROA (Table 3). Further, Japan's Mean Operating Efficiency is the highest (Table 3). However, Canada was very good regarding profitability but that is not the case for Operating Efficiency, as well as the USA (Table 3). Also, median values further confirm the results (Table 3).

Table 3. Descriptive Statistics.

Canada						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	12	13.498	14.100	4.172	5.790	19.530
ROA	12	2.083	0.825	3.236	0.270	11.600
Oper. Eff.	12	0.917	1.107	0.488	0.089	1.484
Bank Assets	12	308.793	229.764	323.736	1.242	844.128
France						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	15	6.339	6.490	0.972	4.850	7.900
ROA	15	0.703	0.740	0.249	0.250	1.080
Oper. Eff.	15	1.763	1.003	1.866	0.842	8.005
Bank Assets	15	368,058.700	20,372.020	735,335.200	9949.270	2,171,141.000
Germany						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	8	6.438	9.185	7.456	−9.960	14.380
ROA	8	0.458	0.455	0.451	−0.390	1.020
Oper. Eff.	8	3.949	1.489	6.278	0.248	18.947
Bank Assets	8	311,742.700	31,550.080	622,597.100	443.440	1,773,685.000
Italy						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	20	8.942	4.980	12.240	−17.200	34.610
ROA	20	0.609	0.370	0.904	−1.250	3.470
Oper. Eff.	20	2.647	1.883	1.898	0.742	8.039
Bank Assets	20	117,767.700	17,743.740	252,461.700	1415.030	936,781.100
Japan						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	20	7.842	7.265	4.243	3.310	17.130
ROA	20	1.919	0.640	2.504	0.190	8.470
Oper. Eff.	20	26.068	0.832	108.341	0.521	486.293
Bank Assets	20	367,340.900	78,015.950	631,359.000	7130.260	2,303,206.000
United Kingdom						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	13	8.764	3.610	13.726	−11.570	28.570
ROA	13	1.345	1.500	1.460	−1.030	3.500
Oper. Eff.	13	1.524	1.427	1.377	0.000	5.717
Bank Assets	13	554,745.400	12,379.120	809,520.900	168.49	2,409,656.000
United States of America						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	50	9.326	8.470	4.284	−0.810	26.730
ROA	50	1.302	1.005	1.410	−0.100	7.960
Oper. Eff.	50	0.523	1.020	3.896	−26.219	4.124
Bank Assets	50	175,867.100	23,761.100	499,853.500	3505.29	2,351,698.000

Source: Calculated by the authors using STATA.

Therefore, Standard Deviation (SD) is examined to see the dispersion of the data set and the results are specific. Also, Canada has a very low Standard Deviation for Operating Efficiency (Table 3) and that means that data are less spread out. In addition, the Standard Deviation (SD) is low in France regarding ROE and ROA (Table 3). Furthermore, low values are for SD ROA in Germany and Italy (Table 3). However, for banks in other countries, values for SD are higher, specifically, Germany's SD, including ROE and Operating Efficiency, as well as Italy's SD for ROE (Table 3). In addition, for the UK, ROE SD is 13.726 (Table 3). However, the highest SD is for Japan's banks' Operating Efficiency (Table 3). Also, all banks in the analyzed countries have quite big differences regarding minimum and maximum values, which means that banks are reliant on profitability and efficiency measures, such as ROE, ROA, and Operating Efficiency. In addition, bank assets vary between countries because some countries have more banks in the sample.

Also, the mean ROE of 10.046 (Table 4) of late adopters is higher than the mean ROE of early adopters (7.797) (Table 4) and the same is true for the mean ROA, as well as for mean Operating Efficiency. Therefore, from this, it is seen that late adopters are quite good performers. However, when median results are examined, the story is different. Specifically, median results show that early adopters have higher ROA and Operating Efficiency (Table 4). Furthermore, late adopters have a slightly higher median ROE of 7.965 (Table 4) than early adopters. Also, Standard Deviation values are high for the Return on Equity regarding both groups (Table 4), which means that data are spread out but it is not the case for other figures. On the other hand, minimum and maximum value differences are big (Table 4). Additionally, early adopters have a higher mean of bank assets.

Table 4. Early and Late Adopters of Basel III.

Earlier Adopters of Basel III Leverage						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	72	7.797	7.950	6.565	−17.200	28.150
ROA	72	1.139	0.940	1.381	−1.250	7.960
Oper. Eff.	72	1.754	1.156	1.670	0.415	8.039
Bank Assets	72	357,013.900	31,476.000	651,944.300	1.242	2,409,656.000
Later Adopters of Basel III Leverage						
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
ROE	66	10.046	7.965	7.982	−9.960	34.610
ROA	66	1.368	0.755	2.050	−0.390	11.600
Oper. Eff.	66	8.531	1.021	59.861	−26.219	486.293
Bank Assets	66	121,526.500	16,189.440	395,719.200	17.530	2,303,206.000

Source: Calculated by the authors using STATA.

Furthermore, Table 5 analyses the results regarding the mean *t*-test. Moreover, regarding Operating Efficiency, the *p* value is 0.338, which is more than 30 percent, which is not significant at a 1% significance level and the same is true for 5% and 10% significance levels. Furthermore, the efficiency of the two groups is overlapping and these are not separate groups. Also, the efficiency measure is not clearly distinct between the two groups. Based on this, in the area of efficiency, it cannot be said who is better, an early or late adopter, when results with equal variances are examined. Additionally, results are the same in the area of efficiency when the *t*-test is run with unequal variances, but the *p* value is 0.361. Specifically, the t-test with equal and unequal variances has the same results and this is positive because it shows that the results are robust.

Table 5. Mean Test.

t-Test Equal Variance					
Ratios	**Groups**	**N**	**Mean**	**Difference in Mean**	**Significance *p* Value**
Return on Assets	Early Adopters	72	1.139	0.229	0.439
	Late Adopters	66	1.368		
Return on Equity	Early Adopters	72	7.797	2.249	0.072
	Late Adopters	66	10.046		
Operating Efficiency	Early Adopters	72	1.754	6.776	0.338
	Late Adopters	66	8.531		
***t*-Test Unequal Variance**					
Ratios	**Groups**	**N**	**Mean**	**Difference in Mean**	**Significance *p* Value**
Return on Assets	Early Adopters	72	1.139	0.229	0.447
	Late Adopters	66	1.368		
Return on Equity	Early Adopters	72	7.797	2.248	0.075
	Late Adopters	66	10.046		
Operating Efficiency	Early Adopters	72	1.754	6.776	0.361
	Late Adopters	66	8.531		

Source: Calculated by the authors using STATA.

Moreover, regarding Return on Assets (Table 5), the group of late adopters has a mean of 1.368 while the group of early adopters has a mean of 1.139, which is not significantly different at the 10% level. Also, the profitability of these two groups does not differ even if they have adopted Basel III leverage requirements earlier or later. In addition, the *p* value is 0.439, which is not significant at a 10% significance level, as well as 5% and 1% regarding the *t*-test with equal variances. However, when the t-test with unequal variances is analyzed, the *p* value is slightly different (Table 5).

However, when Return on Equity is analyzed (Table 5), the mean of late adopters is 10.046 while early adopters have a mean value of 7.797. Also, this is a difference of 2.249 regarding Return on Equity. Therefore, results are very similar when the t-test is performed with unequal variances.

Meanwhile, the median test continuity-corrected Pr values for early and late adopters of Basel III are not statistically significant at 10%, 5%, and 1% (Table 6).

Table 6. Median Test.

Wilcoxon Sign Rank Test (Median Test)	
Ratios	**Continuity-Corrected Pr Values**
Return on Assets	0.121
Return on Equity	0.865
Operating Efficiency	0.394

Source: Calculated by the authors using STATA.

Overall, when results are analyzed, it implies that early adopters of Basel III are not the most profitable or even the most efficient firms and this disproves the two hypotheses that early adopters of Basel III are the most profitable or efficient firms.

Moreover, hypotheses H1 and H2 are rejected because descriptive statistics and tests (mean *t*-test and median tests) did not prove the two hypotheses. Also, results are directed in this specific way because all analyzed countries in the sample are operating as very developed countries where the majority of banks need to comply with strict regulatory requirements. In addition, banks in these countries have more available resources and

higher budgets, as well as experienced staff. Also, banks probably raised the prices of their banking services and passed those costs to the consumers. These are reasons why stricter regulation did not affect the profitability and efficiency of analyzed banks. Furthermore, the adoption of Basel III happened in better economic times and this is the reason why some banks have met new Basel III regulations faster. In addition, banks that are larger in size have met new Basel III regulatory requirements faster and easier.

5. Discussion and Conclusions

Investigating early and late adopters is interesting because it gives insight into good banks regarding the adoption of new regulations. Moreover, banks that adopted new regulations should be in a better position than other banks but that may not be the case. Specifically, early adopters should be more profitable and efficient given their better regulatory situation. Also, this can be the case because early adopters have greater budgets, and they are able to attract more experienced staff than smaller banks (Naceur et al. 2018). In addition, early adopters probably anticipated stricter regulation and they have prepared for adoption.

Therefore, stricter regulation may not automatically mean a harder business environment for banks where banks will be less profitable or less efficient than the late adopters. However, as it is evident further in the research, sometimes there is no clear difference between who is better, early adopters or late adopters, in the area of profitability or efficiency. That means if regulators bring stricter regulation in the future, that would not negatively impact banks as anticipated. Specifically due to sufficient allocation of resources, banks can operate normally despite stricter regulation.

This study intended to see how stricter Basel III regulatory requirements, such as the Basel III Leverage Ratio, affect the profitability and efficiency of banks. Specifically, if banks adopt regulation later, will they struggle? Furthermore, the aims of the study were addressed by classifying banks into early and late adopters based on leverage ratio performance from Fitch Connect, as well as examining bank performance after they were required to adopt regulation. Meanwhile, findings were that banks who adopted regulation earlier are not the most profitable or most efficient firms. Therefore, it implies that banks overall dealt very well with regulation.

Furthermore, the initial thought was that the early adopters of the Basel III Leverage Ratio would have higher profitability and efficiency. Moreover, research is not saying that there is significantly different profitability or better profitability regarding early adopters of Basel III leverage regulation. Also, this means that early adopters are not the most profitable or the most efficient firms. Furthermore, there is no clear difference between these two groups. While the implications of regulatory tightening regarding leverage ratios are not driven by the firms that are profitable or more efficient, it is driven by the factors that can depend on country location or economic conditions. Also, adopting a stricter Basel III Leverage Ratio does not affect profitability and efficiency. In addition, this study showed that banks adopted new regulations very well. Further, policymakers because of the 2008 financial crisis did a good job of identifying weak areas of regulation and improved them. Overall, it implies that the economic stability of the financial system is in better condition.

Previous research did not examine bank adoption of Basel III leverage in the way this research does. Furthermore, the research of other authors is different because these authors focused on and found different things. For example, Acosta-Smith et al. (2020) focused on the leverage ratio and bank risk-taking. In addition, Li (2020) examined how regulation will affect smaller commercial banks. On the other hand, some authors focused on a limited number of countries. Le et al. (2020) examined only UK and Australian banks. Moreover, Obadire et al. (2022) focused only on African countries, and Adelopo et al. (2022) researched only EU banks.

Overall, previous research examined the potential consequences of stricter Basel III regulations generally. This research specifically focuses on Basel III leverage regulation. In addition, this research used a univariate analysis to show whether early adopters are

better in the area of profitability and efficiency, which previous papers did not examine. Also, the view of this research on Basel regulation is unique because previous papers used different methodologies.

This research has the following limitations, such as the analyzed period, which did not cover the COVID-19 impact on bank profitability and efficiency. In addition, only banks in very developed countries are analyzed. Also, only profitability and efficiency ratios are considered. The overall sample of banks could have been bigger and the classification of early and late adopters could have been performed by considering more factors, such as extra events. In addition, more banks from other parts of the world could be included for an analysis to have a better overall picture of the banking system. However, the banks' market capitalization is used in this research but the banks' asset size is another useful metric, which is not considered in this research.

There are a few interesting avenues for future research. For example, future research can analyze banking systems both in developed and developing countries. In addition, the research could focus attention on ratios in the area of risk, liquidity, and capital instead of profitability or efficiency. Moreover, different databases could be utilized for the research, such as Bloomberg. Also, research could analyze bank performance before and after COVID-19.

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